

DOCUMENT RESUME

ED 214 172

CS 206 780

AUTHOR Glassner, Benjamin M.
TITLE Hemispheric Relationships in Composing: An EEG Study.
PUB DATE Mar 82
NOTE 23p.; Paper presented at the Annual Meeting of the Conference on College Composition and Communication (33rd, San Francisco, CA, March 18-20, 1982).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cerebral Dominance; Cognitive Processes; College Students; Higher Education; *Language Processing; *Neurolinguistics; *Neurological Organization; Sex Differences; Student Attitudes; *Writing Processes; *Writing Research

ABSTRACT

The left hemisphere of the brain is analytic and "particularistic" in orientation--focusing on individual elements within a field and analyzing them sequentially. The right hemisphere of the brain is holistic or relational in processing, and is predisposed to see wholes simultaneously. One of the most prominent features of the EEG is the asymmetry between amplitude levels of matched sites in the left and right hemispheres. In a recent hemispheric study, bilateral temporal lobe EEG recordings were obtained for each of 24 college students during four consecutive writing tasks. This was followed by a questionnaire designed to elicit accounts of the students' thoughts, feelings, and operations during each composing process. Results indicated no direct relationship between the assignments and relative shifts in hemispheric engagement. However, a marked difference was indicated between male and female subjects, with women far more likely to engage their right hemispheres. Findings also suggested that extensive composing--aimed at reporting what is already formulated and available in memory, focused on communication and the surface features of texts and more direct and linear in its subprocesses--appears to be chiefly a left-brained activity. Reflexive composing, which is slower and more complex and is focused on discovering and on the active construction of meaning through language, appears to involve a proportionately higher degree of right brain activity. (HOD)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Benjamin M. Glassner

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

HEMISPHERIC RELATIONSHIPS IN COMPOSING:

AN EEG STUDY

Benjamin M Glassner

Michigan Technological University
Houghton, MI 49931

Presented at Conference on College Composition and Communication,
San Francisco, CA, March 18, 1982.

The growing interest of composition teachers and researchers in the operations of the brain is hardly surprising considering our shift in attention from the products to the processes of composing. What the reigning behaviorism of past decades has dismissed as beyond description is first coming to light. The black box is being opened.

Recent research has revealed not the wholly conscious and linear acts characterized by traditional instruction but rather multifaceted complexes of subprocesses which although occurring sometimes linearly, are more often simultaneous and recursive. Although composing's products are necessarily linear (words must be strung in sequence from left to right), and although effective communication reflects the writer's ability to generalize, support and analyze with logic, structure and precision, the processes of thought's formulation do not always share these features. Complex skills are as much a matter of feelings as of logic.

The crucial roles of feelings in writing are expressed in reports of our research and in our resulting pedagogy. For example, Janet Emig, in her introduction to the text Four Worlds of Writing, describes the composing process as:

. . . one that begins with a puzzlement, a curiosity, with a telling word or phrase, and ends with a feeling of satisfaction that comes as a result of having made meaning of your experiences. (p. 3)

Sondra Perl, writing with Arthur Egendorf, suggests that:

What we discover forms out of the flow of experiencing, a further differentiation of, or elaboration from, the sense with which we began. (p. 125).

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

* This document has been reproduced as
received from the person or organization
originating it.

□ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

Yet, Perl goes on to report that although "unskilled" writers usually begin by tapping into their "felt-sense," they often lose the "rhythms generated by thinking and writing" because of their overwhelming concern with the surface features of their texts (Perl, 1978, p. 133). Nancy Sommers (1980) found that the revisions of expert writers occurred far more frequently on a deeper semantic level than those of student writers, in what she called a "complicated relationship between the parts and the whole . . ." (p. 385). She identified as the two crucial elements which student writers most often lack: 1) "the adoption of a holistic perspective," and 2) "the perception that revision is a recursive process" (p. 386). Likewise, Linda Flower and Richard Hayes (1980) found that experienced adult writers are involved in an active search for a "coherent network of ideas" while novices, on the other hand, are tied to the topics themselves, in Flower and Hayes' words, "merely trying to express a network of ideas already formed and available in memory" (p. 28) and "primarily concerned with the features and conventions of written texts" (p. 29).

What has caught the attention of composition theorists, most notably Janet Emig (1978, 1980) and Ross Winterowd (1979), have been findings which suggest that ours is a two-brain system. The most prominent feature of the human brain is the cerebral cortex, a structure divided into two symmetrical hemispheres which are connected down in the fissure between them by the some 200 million nerve fibers of the corpus callosum. Of primary interest to investigators of higher human functions has been the pinkish grey surface structure of the neocortex. Its expansion, particularly in the association areas has been the principal development in higher mammals. These areas integrate and process information from the different sensory regions and are associated particularly with the uniquely human behaviors.

Until fairly recently, investigators have paid attention chiefly to the

structures of the left, so-called "dominant" hemisphere. However, in the past thirty years, reports of specific cognitive deficits resulting from right cerebral injuries have accumulated, the RH increasingly recognized as playing important roles in human thought. Early studies revealed that such patients suffered deficits in the visual perception of spatial relationships. More recent data indicate similar deficiencies with regard to tactile, kinesthetic, and auditory senses (Dimond, 1972). As a result, the original concept of dominance is increasingly giving way to one of hemispheric specialization. Studies of brain injured and neurosurgical patients have shown each hemisphere able to learn, remember and perceive. And most important to our concerns here, higher psychological functions appear to result from a continuous interaction between the two. While participating jointly, each is specialized and analyzes separately the information it receives. (INSERT FIGURE 1). Figure 1 summarizes the principal generalizations of hemispheric functions. (These refer to right-handed adults and most left-handers.)

The LH which controls the right side of the body is analytic and particularistic in orientation. It focuses on individual elements within a field and analyzes them sequentially. Its products are ordered sequences. The RH which controls the left side of the body is holistic or relational in processing. It is pre-disposed to see wholes simultaneously. Its products are gestalts, perceived wholes.

Although damage to the LH generally leads to a disruption of language production and reception and computational skills, damage to the RH to the disruption of spatial and synthetic performance, considerable evidence now suggests a RH role in language activity. While LH processes are crucial in the articulatory, denotative and conscious rule-governed functions of language, RH processes play important roles in affective functions including imagery,

connotation and our sense of emotional appropriateness in discourse (Gardner, 1974; Luria, 1980).

These findings lend new meaning to Britton's (1971) observation that "language is inextricably interwoven with other forms of representation" (p. 260). They suggest that writing is truly a whole-brained activity, our most powerful instrument of thought because, as A. R. Luria (1971) has suggested, of its ability to exist independently of on-going events which allows for the merging of analysis and synthesis.

Until now, the consideration of hemispheric functions in composing has been speculative. The investigation I will report on today has attempted to test these hypotheses empirically. The study relied on the amplitude integration method of EEG signals analysis which is well-established in the literature of neuropsychology. I will now call your attention to FIGURE 2, a chronological record of the relative engagement of the left and right hemispheres of a 22-year old man during the performance of two thinking tasks. This example comes from the work of Leonide Goldstein of the Rutgers Medical School with whom I worked. One of the most prominent features of the EEG is the asymmetry between amplitude levels between matched sites in the L and R hemispheres. It has been demonstrated that the more active cortical involvement, the lower the EEG amplitudes, so that when dealing with the R/L mean ratios, deviations above the overall mean ratio indicate a relatively greater activation of the LH, while deviations below the mean correspond to relatively greater activation of the RH. For fixed periods (in the case before you--10 seconds), digital values of amplitude levels from symmetrically placed electrodes are cumulated. (In this case, electrodes were placed over the L and R temporal lobes in the area of the association cortex.) Each bar in the figure before you represents the arithmetic difference between the successive individual amplitude ratios and the overall ratio for the entire recording period.

In normal right-handed adults such as the subject in this case, the distribution of deviations from the mean amplitude ratio have been shown to be random. This can be seen in the pre-instruction baseline period illustrated in the figure. However, during specific kinds of thinking, clusterings occur--towards higher relative RH involvement during spatial preoccupations and the performance of synthetic tasks and towards higher relative LH involvement during verbal thought.

My own study applied these techniques to the examination of two ten-minute segments of composing each by twenty-four college students. I obtained bilateral temporal lobe EEG recordings for each subject during four consecutive periods: First, recordings were made during two five-minute baseline recordings (one with subjects' eyes closed, then one with subjects' eyes open). Then recordings were taken while subjects composed to two assignments: TASK A--to factually describe a process, how something is done or made, and TASK B--to recount a closely-felt personal experience.

During the recordings, a videocamera was focused on the subject while I monitored the playback in an adjoining room and noted writing behaviors on the direct time-coursed tracings of the EEG signals. Immediately following the recordings, subjects moved to a nearby conference room and responded (speaking into a taperecorder) to a printed questionnaire designed to elicit their accounts of their thoughts, feelings and operations during each composing period.

The subsequent analyses addressed products, composing behaviors and the writers' accounts of their processes according to hypotheses derived from Janet Emig's (1969) study of the composing processes of twelfth graders. Her findings suggest that writing occurs in two principal modes, the extensive, "the mode that focuses upon the writer's conveying a message or communication to another," and the reflexive, "the mode that focuses upon the writer's thoughts and feelings concerning (her) experiences." Writing in the two differed in pace and style.

Extensive reportorial writing was impersonal, more concerned with surface features, and more regular in execution. Reflexive writing was more "tentative, personal and exploratory." Its processes were longer and more complex. In general, I hypothesized that extensive composing would be more likely to engage the processes of the left hemisphere, that reflexive composing would be more integrative, that is, more likely to engage a higher relative involvement of the right hemisphere.

I divided performances on each task into two independent groups, those accompanied by a relative shift to the LH (indicated by an increase in the overall mean R/L amplitude ratio) and those accompanied by a relative shift to RH activation (indicated by a decrease in the ratio). The following measures were then applied. (These hypotheses are illustrated in FIGURE 3).

Texts were holistically rated by independent judges on a six-point scale between extremes denoting the features of extensive and reflexive products. Those written during shifts towards LH activation were expected to be judged closer to the extensive pole; those accompanied by shifts towards RH activation were expected to be judged closer to the reflexive pole.

Next, seven observed behaviors were considered. I expected LH composing to exhibit 1) a shorter pre-writing period, 2) a faster rate of composing, 3) less time spent rescanning or reading, 4) more surface feature revisions, 5) fewer pauses 6) of less length, and therefore 7) less time overall in non-writing activity.

Finally, independent judges rated the features of the composing processes themselves on a six-point scale between extremes denoting the features of extensive and reflexive composing. These ratings were based on the reading of typed transcripts of writers' accounts of their processes. Again, I expected LH composing to exhibit the features of extensive processes, RH composing the features of reflexive processes.

The results of these analyses indicated no direct relationship between

the assignments themselves and relative shifts in hemispheric engagement. Performances on both tasks indicated shifts to both hemispheres. However, a marked difference was indicated between the performances of male and female subjects. Women were far more likely to engage their RH's. This was especially pronounced on Task B, the account of a personal experience. The women were more lateralized in their processes of composing, more likely to engage in writing as a whole-brained activity.

I found no significant relationship between either the features of texts (as indicated by the ratings on the holistic product scale) or observed composing behaviors. The features of texts were not necessarily consistent with those of the processes which produced them, and the processes themselves appear to be too complex and ideosyncratic to be reduced to such discrete generalizations. However, the holistic ratings of writers' processes were significantly related to relative engagement of the hemispheres.

TABLE 1 displays the mean score of the three independent judges' holistic ratings of the features of these writers' composing processes. The three individual scores were cumulated, the range: 3-18, extensive to reflexive respectively. As you can see, composing processes on both tasks were rated closer to the reflexive pole when the writing was accompanied by a greater relative activation of the RH.

While the initial thrust of this investigation focused on the analyses of group data, the dynamics of individual performances cannot be appreciated by such methods. Chronograms of the deviations of individual successive R/L ratios showed evidence of clusterings of extended engagement of each hemisphere within individual performances. Through the examination of the timed record of observed behaviors, the features of texts as well as of the writers' accounts of their processes, in representative cases, I found behavioral and cognitive correlates

for the apparent shifts of writers between the two modes at different stages in their processes.

While time today does not permit a detailed discussion of such cases, I will illustrate by pointing to a few such instances in one case.

FIGURE 4 depicts the chronology of variations of activity levels for Bruce, an 18-year-old of very superior verbal intelligence (WAIS Verbal IQ: 134) as he composed to his first assignment, in this case, TASK B, his account of a personal experience. Unlike the example we looked at earlier, here each bar represents 5 not 10 seconds of recording time. As you can see, the pattern of deviations moves increasingly towards a marked relative shift to RH activation, almost 60% of the deviations falling below the global mean. Bruce's choice of topic was a reflection on a rabbi's recent sermon on the limits of human closeness. In his account of his process, Bruce stated that he did not have a clear idea of what he wanted to say, that he started only with a vague feeling, what he described as "the basic element in the topic" and just started writing. He described his process as "just sort of writing down my internal dialogue." In discussing his text, he noted that it was not until his third sentence that he began to articulate his topic and not until his eighth that he wrote what he considered to be his thesis. Throughout, his approach was tentative and exploratory. At several points he did indicate an awareness of the constraints to be imposed should this piece be directed towards communication, for example, he said:

I guess if I was writing this to be read by other people, I would have gone back and changed the first sentence to fit more closely with what it was that I was trying to say. (AND LATER) I guess that is where I would end the first paragraph if I were trying to write this in composition form.

However, he held these concerns at bay. His first concerns were with making

meaning and discovering form. In the process, he discovered several ideas that had not occurred previously. He reported:

The basic idea, the distance that people keep between themselves and others and closing that distance . . . were there before. . . . The specific ideas, such as "it is almost a mental or emotional territoriality," just came up as I was writing. The idea of it being a defense mechanism and as to why . . . all came up spontaneously as I wrote.

The reflexive nature of his processes were indicated in both the product and process ratings, at the extreme reflexive pole.

FIGURE 5 depicts the chronology of variations for Bruce's performance to TASK A, the description of a process. As you can see, the pattern of deviations here moves to an increasing shift towards relative LH activation. The shift from predominantly RH activity in the pre-writing and early composing periods to predominantly LH composing later on is clarified by Bruce's account of his process. The first subject that came to mind was making a pot on a potter's wheel, but after some deliberation, he rejected it, because (in his words):

I felt that I couldn't break it down into its component parts, and because it's more difficult to describe something like that without having it in front to demonstrate because it is difficult to describe pressure and how to feel it . . .

This attempt to articulate such somatic imagery should account for the predominance of RH activity in the pre-writing period. Bruce then chose a subject with which he was quite familiar, the proper way to hit a tennis ball. In his words, this topic was "something that I analyzed a lot and spent a great deal of time thinking about." Planning was not necessary for, as he stated, "I already had it well-broken down in my head." He began immediately to write.

However, the predominantly RH activation continues well into the initial composing. Again, Bruce's account provides an explanation. He began with a thesis statement: "There are several important basic elements to hitting a tennis ball." In the next sentence, he began to articulate what he considered to be the misplaced concerns of novices which was, he reported, quite easy to write until he attempted to complete the series he had begun. After writing two items, he paused, tried but failed to decide on an appropriate third item and settled for an unsatisfactory alternative, "other things not basic to the act of hitting the ball." His explanation suggests that he experienced what Sondra Perl would call a "felt-sense" but was unable to construct his meaning in language. In Bruce's words:

I wanted to describe more things that people were concerned with because it sounds better when you write something like that and also because I wanted to describe more things . . . but I couldn't think of anything specifically, so I gave a vaguer example of what I wanted to say.

As you can see on FIGURE 5, this first pause and the period immediately following it were accompanied by a large cluster of RH activation.

Bruce's comments on this thoughts and feelings indicate that the rest of his process was smooth, primarily concerned with the effect of his communication on his audience. His process was linear and direct, his material quite familiar. The extensive nature of his overall process was reflected in both product and process ratings, the product rating at the extreme extensive pole, the process rating quite close to it.

This investigation represents only a mere glimpse into an exciting new territory for composing process research. Its findings suggest that there are indeed two principal modes of composing as proposed by Emig (1969) and that

they are related to the separate but interacting spheres of the cerebral cortex. Extensive composing, aimed at reporting what is already formulated and available in memory, focused on communication and the surface features of texts, more direct and linear in its subprocesses, appears to be chiefly a left-brained activity. Reflexive composing, slower and more complex, its focus on discovering, on the active construction of meaning through language, appears to involve a proportionately higher degree of right-brained activity. The examinations of individual cases further suggest that most composing consists of a complex interplay of these modes.

The investigation of hemispheric relationships in composing has clearly just begun. The conclusions drawn from this study are at best tentative owing to the small sample and the limited composing time observed. However, if this study persuades others that these relationships are worth further investigation, it will have served its purpose.

Hemispheric Relationships in Composing:

An EEG Study

Benjamin M Glassner

Michigan Technological University

Houghton, MI 49931

BIBLIOGRAPHY

- Bogen, J. E. The other side of the brain II: An appositional mind. Bulletin of the Los Angeles Neurological Societies, 1969, 34, 135-162.
- Britton, J. What's the use? Educational Review, 1971, 23, 205-291.
- Dimond, S. A. The double brain. Baltimore: Williams & Wilkins, 1972.
- Emig, J. A. Components of the composing process among twelfth grade writers (Doctoral dissertation, Harvard University, 1969).
- Emig, J. The composing processes of twelfth graders. Urbana: Ill., NCTE, 1971.
- Emig, J. Hand, eye and brain. In J. R. Cooper & L. Odell (Eds.) Research on composing. Urbana, Ill.: NCTE, 1978.
- Emig, J. The tacit tradition. In A. Freedman & I. Pringle (Eds.) Reinventing the rhetorical tradition. Conway, Ark.: L & S Books, 1980.
- Emig, J. et al. Four worlds of writing. New York: Harper & Row, 1981.
- Flower, L. & Hayes, J. R. The cognition of discovery. College Composition and Communication, 1980, 31, 21-32.
- Gardner, H. The shattered mind. New York: Alfred A. Knopf, 1974.
- Glassner, B. M. Preliminary report: Hemispheric relationships in composing. Journal of Education, 1980, 162, 72-95.
- Glassner, B. M. Writing as an integrator of hemispheric function. In B. Kroll & R. Vann (Eds.) Exploring speaking-writing relationships, Urbana, Ill.: NCTE, 1981.
- Goldstein, I. Some relationships between quantified hemispheric EEG and behavioral states in man. In J. Gruzeliier & P. Flor-Henri (Eds.) Hemispheric asymmetries of function in psychopathology. Elsevier: North-Holland Biomedical Press, 1979.
- Luria, A. R. Higher cortical functions in man. 2nd American ed. (B. Haigh, trans.), New York: Basic Books, 1980.

- Luria, A. R., & Yudovich, F. Ia. Speech and the development of mental processes in the child. (J. Simon, trans.), Baltimore: Penguin, 1971.
- Perl, S. A. Five writers writing: Case studies of the composing processes of unskilled college writers (Doctoral dissertation, New York University, 1978).
- Perl, S., & Egendorf, A. The process of creative discovery. In D. McQuade (Ed.) Linguistics, stylistics, and the teaching of composition. Akron, Ohio: University of Akron, 1979.
- Sommers, N. Revision strategies of student writers and experienced adult writers. College Composition and Communication. 1980, 31, 378-388.
- Winterowd, R. Brain, rhetoric, and style. In D. McQuade (Ed.) Linguistics, stylistics, and the teaching of composition. Akron, Ohio: University of Akron, 1979.

PRINCIPAL GENERALIZATIONS OF HEMISPHERIC FUNCTIONS

LEFT HEMISPHERE		RIGHT HEMISPHERE
RIGHT SIDE OF THE BODY	MOTOR CONTROL	LEFT SIDE OF THE BODY
ANALYTIC, PARTICULARISTIC	MODE	HOLISTIC, RELATIONAL
SEQUENTIAL (OVER TIME)	PROCESSING	SIMULTANEOUS (INTEGRATES MANY INPUTS AT ONCE)
ORDERED SEQUENCES	PRODUCTS	GESTALTS, PERCEIVED WHOLES

FIGURE 1

CHRONOGRAM OF RELATIVE HEMISPHERIC ENGAGEMENT
OF A 22 YEAR-OLD NORMAL MALE SUBJECT
DURING THREE MENTAL STATES

SUCCESSIVE DEVIATIONS FROM
MEAN R/L EEG AMPLITUDE RATIOS

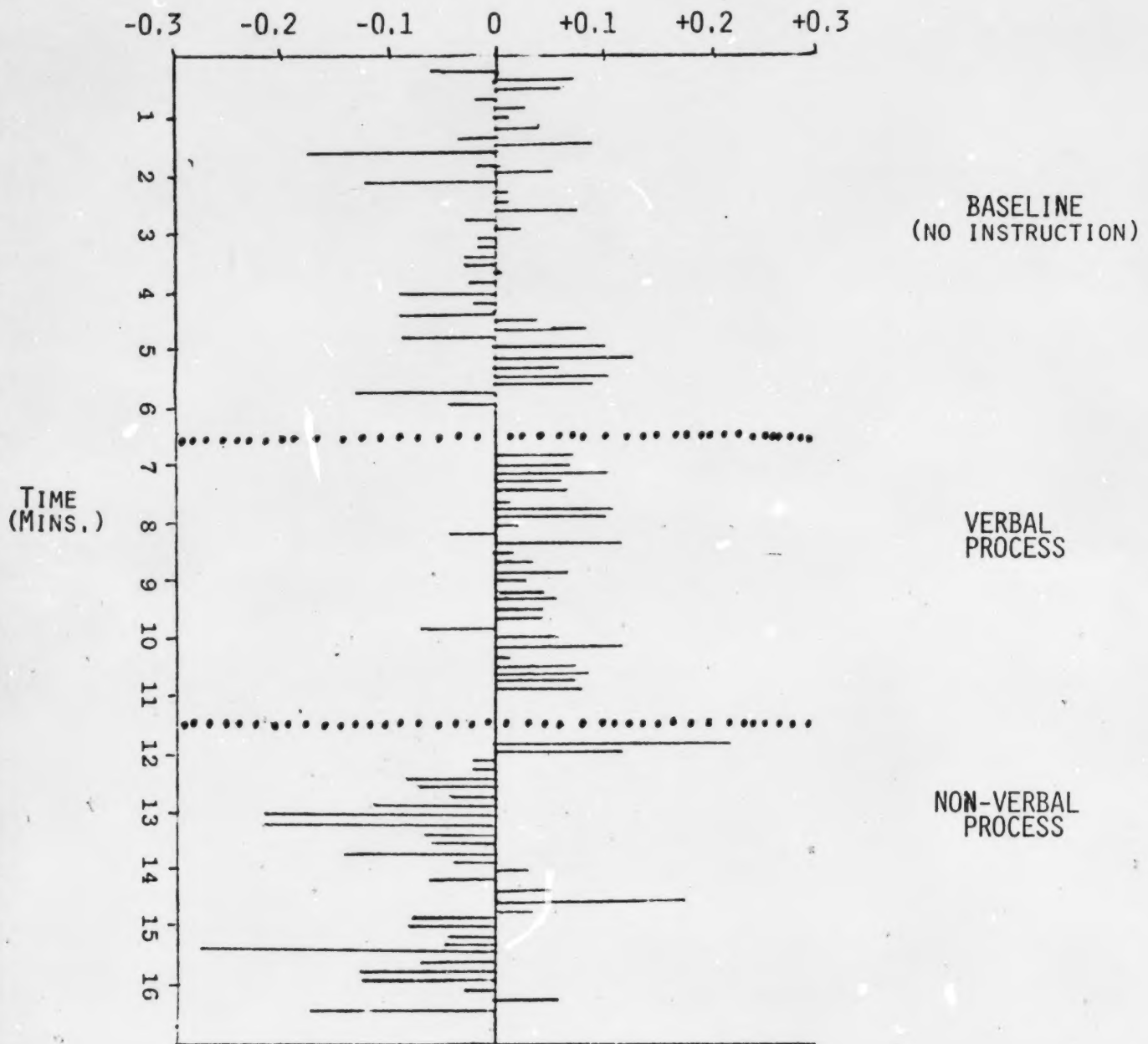


FIGURE 2
(TAKEN FROM GOLDSTEIN, 1978)

COMPOSING PROCESS VARIABLES
AND RELATED HYPOTHESES

PRODUCT

1. RATING SCALE: EXTENSIVE (1) TO REFLEXIVE (6)
RIGHT SHIFT > LEFT SHIFT

OBSERVED BEHAVIORS

2. PRE-WRITING TIME (SECONDS)
RIGHT SHIFT > LEFT SHIFT
3. RATE OF COMPOSING (WORDS/MINUTE)
LEFT SHIFT > RIGHT SHIFT
4. PERCENT OF TOTAL TIME RESCANNING OR READING
RIGHT SHIFT > LEFT SHIFT
5. REVISION RATE (N/100 WORDS)
LEFT SHIFT > RIGHT SHIFT
6. PAUSE RATE (STOPS/MINUTE)
RIGHT SHIFT > LEFT SHIFT
7. MEAN PAUSE LENGTH (SECONDS)
RIGHT SHIFT > LEFT SHIFT
8. PERCENT OF TOTAL TIME IN NON-WRITING ACTIVITY
RIGHT SHIFT > LEFT SHIFT

PROCESS

9. RATING SCALE: EXTENSIVE (1) TO REFLEXIVE (6)
RIGHT SHIFT > LEFT SHIFT

FIGURE 3

TABLE 1

TESTS OF HYPOTHESIS OF DIFFERENCE BETWEEN TWO INDEPENDENT

MEANS: LEFT (L) AND RIGHT (R) SHIFT

PROCESS RATING

RANGE: 3 - 18, EXTENSIVE TO REFLEXIVE

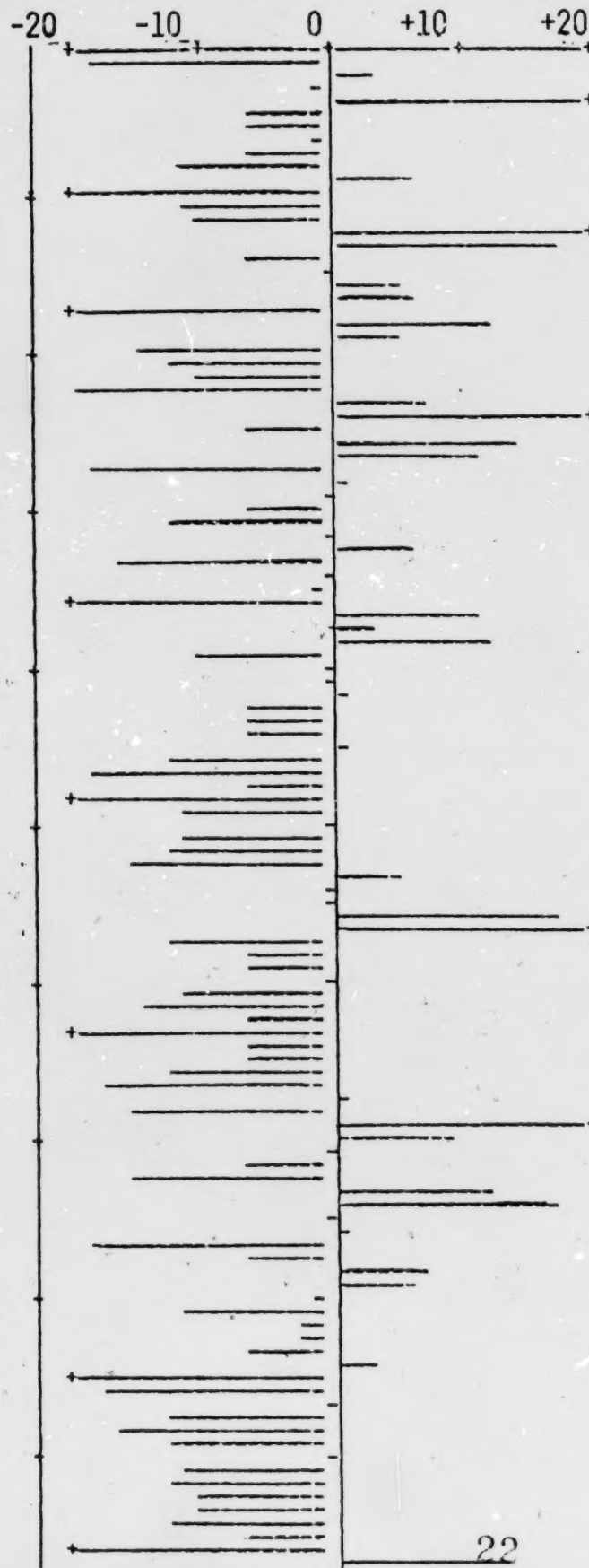
DE = 22H₀: UR - UL ≤ 0H_A: UR - UL > 0

TASK	MEAN SCORES		STANDARD DEVIATION		T-SCORE	LEVEL OF SIGNIFICANCE
	LEFT SHIFT (N)	RIGHT SHIFT (N)	LEFT SHIFT	RIGHT SHIFT		
A	6.933 (15)	9.444 (9)	3.305	2.555	1.950	p < .05
B	7.467 (15)	12.556 (9)	3.720	3.237	3.237	p < .005

NOTE: The following figures represent chronograms of the relative states of activation in the LEFT and/or RIGHT hemispheres (temporal loci). Bruce, an 18-year old of very superior verbal intelligence (WAIS Verbal I.Q.: 134) composed to two writing tasks: TASK B--to recall a closely-felt personal experience (Figure 4) and TASK A--to factually describe a process, how something is done or made (Figure 5).

Each bar on the chronograms represents the arithmetic difference ($\times 100$) between the successive individual R/L amplitude ratios and the overall mean R/L ratio for the whole recording period. Positive deviations occur when the activity is relatively greater in the LEFT HEMISPHERE since greater activity is manifested by lower amplitude (>1.0 in the R/L computations). The reverse occurs with relatively greater activity in the RIGHT HEMISPHERE (<1.0 in the R/L computations).

SUCCESSIVE DEVIATIONS FROM THE MEAN R/L AMPLITUDE RATIO X 100



PRE-WRITING

WRITES

PAUSE

WRITES

READS TEXT

WRITES

READS TEXT

WRITES

PAUSE

WRITES

PAUSE

WRITES

FEELS NEED TO TURN
TO PERSONAL EXPER.

WRITES

GLANCES AT 1ST
PAGE

FIGURE 4

COMPOSING TO
TASK B

TIME
(MINS.)

SUCCESSIVE DEVIATIONS FROM THE
MEAN R/L AMPLITUDE RATIO X 100

FIGURE 5

COMPOSING TO
TASK A

TIME
(MINS.)

